



**Standard: 3240-03:** Students will relate forces and energy to motion.  
**Objective: 3240-0301:** The student will demonstrate the result of forces.

**Intended Learning Outcomes:**

1. Make observations and measurements (uses instruments as appropriate).
- 1d. Make estimations and predictions based on observations and current knowledge.
2. Identify variables and describe relationships between them.
2. Plan field studies, controlled experiments, and other investigations.
- 2g. Construct models and simulations to describe and explain natural phenomena.

This activity is a great and fun way to teach Archimedes' principle. Each team of students (2) will construct a boat that will keep afloat the most amount of marbles possible. When the boat eventually sinks, the total number of marbles in the sunken boat will be recorded. The winning team will be decided on this basis.

Archimedes' principle states that the buoyant force on an object is equal to the weight of the fluid displaced by the object.

**Materials Needed:**

- Square aluminum foil sheets for each student. 6" by 6" size is good.
- Container for water (tub, bucket, sink, etc.)
- Tub of marbles (50-100 depending on class size)

**Procedure**

1. Make a boat of some type out of your foil paper.
2. Put your boat into the container of water and begin to place marbles in one at a time (See Rule # 2)
3. Place your marbles evenly throughout your boat. Make sure you balance your weight evenly.

**Rules**

1. You only have one attempt. You may not start over once you begin placing marbles in the boat.
2. You must wait three seconds before you can place another marble in your boat.
3. When your boat sinks, count the number of marbles in your sunken boat.

**Safety concerns:**

Students, be sure to follow all [teacher directions](#) and instructions for all general laboratory experiences.

**Variations:**

Instead of counting the number of marbles in the sunken boat, disqualify all boats that sink. The winner is the boat that stays afloat with the most amount of marble. If the boat remains afloat for thirty seconds after the last marble has been placed, then the count will be considered. This will test the students' design, dexterity, and gambling skills.

Float the boat in an overflow container and collect the water displaced by the boat as it is filled with marbles. The mass of the water should equal the mass of the boat and the marbles. Have students check it out doing the math to see if Archimedes' Principle holds.

**Conclusion**

1. In what way does the **size** of the boats make a difference in the amount of marbles they held? Please be specific.
2. In what way does the **design** of the boats make a difference in the amount of marbles they held? Please be specific.
3. Please describe which design held the most marbles and **why**.
4. What would you do different next time?



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